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DECLARATION

The undersigned, Olaf Bexhoeft, hereby states that he is well acquainted with both the English and German languages and that the attached is a true translation to the best of his knowledge and ability of the German text of PCT/DE2003/002348, filed on 07/12/2003, and published on 02/26/2004 under No. WO 2004/016431 A1.

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

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Specification

Method and Device for Reducing Vibrations on Rotating Parts, and Vibration-Damped Rotating Part

The invention relates to a method and a device for reducing vibrations of rotating components, as well as to a vibration-damped rotating component in accordance with the preambles of claims 1, 9 or 28.

EP 0 194 618 B1 discloses a device for reducing vibrations caused by rolling over a groove located on the surface area. A raise in height of the circular contour for affecting the force change behavior is provided here in the entry or exit area of the groove.

A method for compensating vibrations of rotating components is disclosed in WO 01/50035 A1, wherein an actuator is arranged in the area of the surface of the rotating component, which counteracts the vibration by means of a force component in the axial direction when it is activated as a function of the angle of rotation position of the rotating component.

The object of the invention is based on creating a method and a device for reducing vibrations of rotating components, as well as a vibration damped component.

In accordance with the invention, this object is attained by means of the characterizing portions of claims 1, 9 or 28.

The advantages to be gained by means of the invention lie in particular in that a possibility for effectively and variably reducing vibrations has been created. The reduction

of the vibrations can take place actively, and possibly adaptively, during a production run and can be matched to the operating requirements.

The method and the device can be employed with particular advantage in connection with at least one of two components rolling off on one another, for example cylinders or rollers wherein, viewed in the circumferential direction, at least one of the components has at least one interruption, for example a groove, on its surface area.

By means of the ability to change, in particular by remote control, the geometry and/or position and/or the height of the raised area(s) on the surface area, the vibration can be optimally reduced via the various operational states, such as the speed of rotation, for example, on the one hand. On the other hand, the geometry and/or the position or height per revolution, or a part of the revolution, can be changed or modulated in order to do justice to the roll-over of the interruption at each nip point, for example in connection with the contact of the rotating body with several cylinders and/or rollers.

In an advantageous embodiment an actuator, which can be remotely controlled, is designed as an actuator which can be charged with a pressure medium, for example as a hydraulic or pneumatic unit. In a variation it is designed piezo-electrically.

Exemplary embodiments of the invention are represented in the drawings and will be described in greater detail in what follows.

Shown are in:

Fig. 1, a basic sketch of two rotating components working together,

Fig. 2, an enlarged representation of a nip point in accordance with Fig. 1,

Fig. 3, qualitative courses of an acceleration as a function of time (A: vibration without the formation of a raised area, B: with the formation of a raised area),

Fig. 4, a first exemplary embodiment of the device for reducing vibrations,

Fig. 5, a first exemplary embodiment of the integration of a clamping or bracing device,

Fig. 6, a second exemplary embodiment of the integration of a clamping or bracing device,

Fig. 7, a third exemplary embodiment of the integration of a clamping or bracing device,

Fig. 8, a schematic representation of the method for controlling the device,

Fig. 9, a qualitative representation of the interrelationship between a roll-off speed and the height of the raised area, or of the pressure,

Fig. 10, a schematic representation of the method for regulating the device,

Fig. 11, a qualitative representation of the interrelationship between a relative amplitude and the height of the raised area, or of the pressure,

Fig. 12, a schematic representation of the method for regulating the device with four rotating components acting together respectively in pairs.

A rotating component 01, for example a cylinder 01, or a roller 01 of a machine, for example a treatment or processing machine for webs and sheets, in particular of a rotary printing press, cooperates in the contact position AN with a second rotating component 02, for example a cylinder 02 or a roller 02. The two components 01, 02, called cylinders 01, 02 in what follows, roll off on each other in the area of their effective surface areas 03, 04 and have been placed against each other in the contact position AN with a force which, for example, can be predetermined or set (Fig. 1). In an advantageous manner, the invention can also be applied to rollers and cylinders of machinery for producing web-shaped material, for example paper or sheet metal, etc., in impression cylinders or rolling mills.

At least one of the cylinders 01, 02, here for example the cylinder 01 designed as a transfer cylinder 01 has, in the area of its effective surface area 03, at least one axially extending interruption 06 of a contour which otherwise is circular in the unstressed state. The interruption 06 is for example based on a joint of ends of one or several dressings 07 arranged on the cylinder 01, or in that the ends of one or several dressings 07 are arranged in a groove 08 extending in an area close to the surface of the cylinder 01. An opening from the surface area of the cylinder 01 to the groove 08 is kept as small as possible, and in an advantageous embodiment is maximally 3 mm. The groove 08 can widen toward the interior and can have a device 10 for clamping and/or bracing (Fig. 4). However, it can also be designed as a slit 08.

In the contact position AN, the two cylinders 01, 02 are placed against each other with a force greater than zero, and in the course of the passage of the interruption 06 through the nip point they undergo a relief as well as a subsequent renewed stress. A vibration of the cylinder 01, 02, or cylinders 01, 02, is excited by this which is, inter alia, a function of the contact forces, the geometry of the interruptions 06 and the cylinders 01, 02, the properties of the material, and the number of revolutions, or off a roll-off speed v. Such a vibration, curve A, is qualitatively represented in Fig. 3, wherein the dashed area identifies the passage of the interruption 06 through the nip point. This vibration, excited by the passage of the interruption(s) 06, has been damped and should not be confused at this point with vibrations possibly induced in the individual cylinders 01, 02 by balance errors, or with a bending caused by gravity and/or the line force. The vibration is excited per revolution of the cylinder 01, 02 in the circumferential direction once per interruption 06 and nip point.

For damping the vibration, at least one of the cylinders 01, 02, here for example the cylinder 02 designed as a forme cylinder 02, has at least one axially extending raised area 09 of a contour, which otherwise is circular in the unstressed state, in the area of its effective surface 04. This raised area 09 can extend axially continuously over a length of the effective barrel, or also in one or several sections in the axial direction. As indicated in Fig. 2, the raised area 09 has a height h09 (the maximum) in respect to the undisturbed contour, and an effective distance a09 (the

maximum) from the interruption 06 in relation to a roll-off path at the rotating cylinders 01, 02.

Viewing the passage of the raised area 09 by itself, a vibration is also induced in the cylinders 01, 02 rolling off on each other. Depending on the relative position in respect to the passage over the interruption 09, i.e. depending on the rolled-off distance a09 (phase relation) and the height h09, and/or the shape of the raised area 09, this counter-vibration causes an increase or decrease (in the ideal case cancellation) of the vibration amplitude caused by the passage of the interruption 09. Depending on its shape and position, the raised area 09 provides a support effect between the cylinders 01, 02, which are radially moved in respect to each other by the excitation.

The height and shape of the generated counter-vibration is partially a function of the shape of the raised area 09 and - in case of an asymmetrical shape in respect to the circumferential direction - a function of the direction of rotation of the cylinders 01, 02 rolling off on each other. A course of the resultant curve B of the vibration, caused by the superimposition of the vibration and counter-vibration is represented in Fig. 3, wherein the excitation was generated by the raised area 09 in the form of a ramp (see below). An increase in the amplitude of the acceleration, which can initially be detected in the area of the passage of the interruption 09, which initially can be detected in the area of the passage of the interruption 09, is already followed by a clear decrease in the second period. Since the area of the interruption 09 is a non-printing area, the brief increase of the resultant vibration does not have a negative effect on

the printed image, but the subsequent decrease has a positive effect.

The raised area 09 is now designed in such a way that its height a09 can be changed in respect to the undisturbed contour, in particular during the operation, i.e.during the roll-off of the cylinders 01, 02. To this end the cylinder 02 has means 11 for changing the height h09, for example actuating means 11, in particular a remotely controllable actuator 11. In an advantageous embodiment the distance a09 (Fig. 4) is also designed to be changeable.

The raised area 09 can be technically realized in various ways. It is thus possible, for example, for fingers, which have been given a suitable shape, to be sunk in a comb-like manner into recesses in the surface area of the base body of the cylinders 01, 02, and to be radially movable by linear or rotatory movements via an actuating means 11. A variation is also possible, wherein an area of the surface 03, 04 has been designed to be elastically deformable or elastically resilient within defined limits and to be deflectable in the radial direction by an actuating means 11, for example cams or an eccentric shaft, or other actuators, arranged in the interior of the cylinder.

The actuator 11, or the actuators 11, can also be designed in different ways, for example as a function of the design of the raised are. It can be designed as a part of a motor-driven, a hydraulically or pneumatically driven unit, or as a unit based on magnetic or piezo-electric forces.

In the following exemplary embodiments (Figs. 4 to 12), the device and the method are represented by means of the example of a raised area 09 designed as a tongue/lip/bracket

09, which can be substantially bent, reversibly springing back, out of the contour of the surface area 03, 04. The activator 11 actuating the tongue/lip/bracket 09 has been designed here as a part of a hydraulically operating unit.

In Fig. 4, the cylinder 02, here the forme cylinder 02, working together with the transfer cylinder 01, has the tongue/lip/bracket 09, which can be raised. The tongue/lip/bracket 09 in the form of a one-armed lever is embodied by a groove 12, axially extending inside of the surface area 04, and an interruption 13 of the surface area, connecting the groove 12 with its surroundings, for example an axial cut 13. The tongue/lip/bracket 09 can be raised by means of a hydraulic unit, which has as an actuator 11 a reversibly deformable hollow body 11, which can be charged with a pressure medium, in the groove 12 axially extending in the cylinder 02. The hollow body 11 is arranged directly underneath the tongue/lip/bracket 09 in the interior of the cylinder 02 and is supported toward the interior in the radial direction at least partially on a cylindrical face 14, fixed in place on the cylinder.

Also represented in Fig. 4 is the effective distance a09 between the maximum raised area 09 (here the edge of the cut) and the interruption 06, as well as an effective length l09 of the leg of the tongue/lip/bracket 09. The effective leg length l09 represents the length of the tongue/lip/bracket 09 in the circumferential direction from the edge of the cut to the point at which the tongue/lip/bracket 09 is "undermined" by the groove 12, viewed in the radial direction. In an advantageous embodiment, the tongue/lip bracket 09 extends over the entire

length of a barrel of the cylinder 02. In Fig. 4, the tongue/lip/bracket 09 is represented in an active position, i.e. the actuator 11 is effective. In another embodiment with staggered cylinder grooves, or dressings, i.e. several interruptions 06 arranged side-by-side in the axial direction are arranged offset in respect to each other in the circumferential direction, several of the raised areas 09 can be arranged staggered in the same way.

The actuator 11, embodied as a hollow body 11, receives its fluid, or the pressure P, from the outside, for example via a rotary throughput, not represented, in the area of a journal, not represented, of the cylinder 03.

When placed against each other, the forme cylinder 02 acts together with the transfer cylinder 01, on whose surface the dressing 07, for example a rubber blanket 07, has been braced. Ends 16, 17 of the single, or of two dressings 07 arranged one behind the other in the circumferential direction, are maintained by means of a clamping and/or bracing device located in the groove 08. The interruption 06 in the effective surface area 03 is formed in the area where the ends 16, 17 leave the opening of the groove 08.

In an advantageous embodiment, the distance a09 is a length corresponding to a path of a sector of the cylinder 01, 02 of an opening angle of -1 to 8°, in particular 3 to 6°, on the surface area 03.

In an advantageous embodiment with cylinders 01, 02 of a length 101, 102 of 1,350 to 1,550 mm, and an effective circumference of 420 to 700 mm, in particular 500 to 600 mm, the tongue/lip/bracket 09 has an effective leg length 109 of

10 to 30 mm, in particular 16 to 21 mm. The distance a09 is, for example, 1.25 to 15 mm, in particular 4 mm to 10 mm.

The ratio between the distance a09 and the circumference lies between 0.002 and 0.02, in particular between 0.005 and 0.015. The ratio between the leg length l09 and the circumference lies between 0.02 and 0.04, in particular between 0.03 and 0.035.

The raised area 09, designed as a tongue/lip/bracket 09 in accordance with Fig. 4, has been made asymmetric in respect to the direction of rotation of the cylinder 01, 02, or of the cylinders 01, 02. In one direction, the raised area 03 acts in a ramp shape with a correspondingly shaped impulse, while in the other direction of rotation an impulse is induced at a discontinuous skip location. Both forms show the above described effect wherein, however, the excitation with travel over the ramp/the direction of rotation with a discontinuous skip location is of greater advantage.

The height h09 and/or the distance a09 can be set differently, depending on the direction of rotation, number of rotations and force of the contact (linear force) between the cylinders 01, 02. For this purpose it is possible to supply the direction of rotation as a value g defining the printing press status or the printing press to a control or regulating device explained further down below.

A raised area 09 corresponding or similar to the arrangement represented in Fig. 4 by way of example by the forme cylinder 02 can be arranged on the transfer cylinder 01, either additionally or in place of the forme cylinder 02. Different variations for integrating a clamping device for

the dressing 07, or its ends 16, 17 are represented in subsequent Figs. 5 to 7. These arrangements can be applied to dressings 07 embodied as printing formes 07 on the forme cylinder 02, or as rubber blankets 07 on the transfer cylinder 01. In the case of rubber blankets 07, the use of metallic printing blankets 07 (elastically deformable layer on a metal support) is advantageous, since these can be designed in the area of their ends similar to those of printing formes 07 and can be clamped in the groove 08.

In Fig. 5, the interruption 13 is embodied as an opening 13 in such a way that it has been made very narrow, less than or equal to 3 mm, wherein the ends 16, 17, for example dressing ends 16, 17, are merely suspended.

In Fig. 6, the interruption 13 is embodied as an opening 13 in such a way that the actuator 11 simultaneously acts on one or two dressing ends 16, 17, either via a lever mechanism 20 (only schematically indicated), or directly, and clamps them.

In Fig. 7, the interruption 13 is embodied as an opening 13 in such a way that, for example, the leading dressing end 16 is substantially held in place by the shape of the edge, and the trailing dressing end 17 is clamped by the actuator 11.

As explained above, the height h09 of the raised area 09 is made to be changeable. Exemplary embodiments of the method for controlling or regulating, and the device required therefore, will be explained in what follows.

In a first exemplary embodiment (Fig. 8), the reduction takes place by means of a control system, which can contain a lower order regulating circuit.

A value v defining the printing press status, in particular the roll-off speed v, such as the number of revolutions or the angular speed, for example, is used as the command variable of the higher order control system. This value v can be obtained, for example together with other values g defining the printing press status or the printing press, from a higher order printing press control device, or can also be measured in a suitable manner. Now, a reference variable of the manipulated variable is assigned to the value v in a logical unit 18 by means of a stored interrelationship (by means of a table, arithmetically, etc.) as the output value of the logical unit 18. The manipulated variable can directly be a desired height h09 of the raised area 09, a pressure P, a distance S, a voltage U, etc. Accordingly, a reference variable $h09_{SOLL}$ for the height h09 of the raised area 09, a reference variable P_{SOLL} for the pressure P of a hydraulic unit, a reference variable S_{SOLL} for a travel or position signal S of an actuator 11, or a reference variable U_{SOLL} for the voltage signal U of an actuator 11, are determined as the output values. This reference variable $h09_{SOLL}$, P_{SOLL}, S_{SOLL}, U_{SOLL}, is again used as a command variable for a lower order regulator device 19. A regulating device 21, for example a regulator 21, and in particular a controlled system 22 of the regulating device 21, can now be embodied in different ways, matched to the type of the actuator 11 and the input values.

A functional, or algebraic, in particular a linear interrelationship between the roll-off speed v and the desired raised area 09 (or an appropriate travel, pressure or voltage signal) has been stored in the logical unit 18 as the

logic. This (in particular linearized) interrelationship between the roll-off speed v and the reference variable $h09_{SOLL}$, P_{SOLL}, S_{SOLL}, U_{SOLL} for the height h09 of the raised area 09, or the pressure P, the travel S or the voltage U can be present many times for different cylinder geometries and/or for values g defining the printing press status or the printing press, and can be appropriately selected (Fig. 9, interrelationships C, D).

Such an interrelationship can also be advantageously used for starting and running up the printing press, so that a suitable raised area 09 is provided in connection with each roll-off speed v.

In a further development, the regulating device permits an optimization of the actual production conditions or circumstances by means of its adaptive structure.

In case of a hydraulic unit in accordance with the exemplary embodiments in Figs. 4 to 7, a linearized interrelationship between the roll-off speed v and the reference value P_{SOLL} for the pressure P is stored as the logic, for example. A known interrelationship between the pressure P in the hollow body 11 and the resulting height h09 of the raised area 09 can be the basis for this logic. Now, the actuator 11 embodied as as a hollow body 11 is charged with the appropriate pressure P, which is maintained, if required, by means of the regulator device 19, via the controlled system 22 embodied as a valve 22, wherein an actual value P_{IST} is returned to the lower order regulating circuit (this accordingly applies to the manipulated values S, U, h09, which differ from the pressure P). Thus, the tongue/lip/bracket 09 is raised by the corresponding height

h09 as a function of the roll-off speed v and in accordance with the existing pressure P_{IST} and is maintained there. If the roll-off speed v, or another production condition, changes, the pressure P (or other manipulated values) is again determined and set. No continuous checking of the roll-off speed v need be performed, instead, this can take place in discrete intervals, for example following a fixed number of cylinder revolutions. In a further development, a starting value P_{IST} can also be supplied to the lower order regulating circuit, which can be predetermined from a printing press control, or also manually, for example during the start-up phase or under extremely non-stationary conditions.

In a further exemplary embodiment (Fig. 10), the reduction takes place by means of a higher order regulating device, which can again contain the above described regulating circuit of the lower order regulator device 19.

In contrast to Fig. 8, a value e(t), which defines the vibration, is fed as the input value to the logical unit 18. In particular, the value e(t) contains a relative value between amplitudes a1, a2, which are measured at both cylinders 01, 02 and are projected on a plane through the axes of rotation of the two cylinders 01, 02. Therefore, in what follows the value e(t) will also be called a relative amplitude e(t). If the two cylinders 01, 02 vibrate equiphased in this plane at the same amplitude e(t), a value of zero would result. In addition, as in Fig. 8, the roll-off speed v and/or other values g defining the printing press status or the printing press, can also be supplied as input values. In a further difference with Fig. 8, the logical

unit 18 has an optimization algorithm which varies the output values $h09_{SOLL}$, P_{SOLL} on the basis of the values e(t) in such a way that e(t) is minimized.

In an advantageous embodiment, the variation takes place along interrelationships stored in the logical unit 18, for example the dependence of the relative amplitude e(t) from the height h09 or the pressure P (Fig. 11), or the distance a09. It is possible to preset a group of curves or an arithmetic connection for different ranges of the roll-off speed v (for example the number of revolutions). With the roll-off speed v (or number of revolutions) known, a variation now takes place along the interrelationship preset for this roll-off speed v (or number of revolutions). For example, in Fig. 11 a curve identified by v1 denotes a number of revolutions of 20,000 rph, v2 40,000 rph, v3 60,000 rph and v4 80,000 rph. Here, too, a measurement of the vibrations and a variation possibly resulting therefrom need not take place continuously, but can be determined regularly within finite time intervals, or in accordance with a defined number of cylinder revolutions.

Further processing of the reference variable $h09_{SOLL}$, P_{SOLL} generated in the logical unit in the described manner takes place in accordance with the way explained in connection with Fig. 8.

Fig. 12 shows a multi-roller system, in particular a four-roller system, wherein the already described transfer cylinder 01 does not only work together with its forme cylinder 02, but in the contact position AN with a further component 23, for example a cylinder 23 as a counter-pressure cylinder 23, in this case a second transfer cylinder 23. A

component 24, for example a cylinder 24, for example a second forme cylinder 24, is assigned to the second transfer cylinder 23 and works together with the latter in the contact position AN. Only two of the four cylinders 01, 02, 23, 24, in particular the two transfer cylinders 01, 23, have an actuator 11 and a raised area 09, whose height h09 and/or phase relation (distance a09) can be changed. The principal functioning can also be applied to other multi-roller systems, such as satellite units with 3, 9 or 10 cooperating cylinder, for example.

Analogously to the exemplary embodiment in accordance with Fig. 10, four amplitudes, or vibration courses a1, a2, a3, a4 (corresponding to the number of cylinders) of the cylinders 01, 02, 23, 24 involved are determined, and from this a number of relative amplitudes e1(t), e2(1), e3(1) corresponding to the number of nip points is formed, which are supplied as input values to the logical unit 18. Now, the optimization algorithm has an interrelationship per each nip point for the respective passage of the raised area 09, or the interruption 06, through the nip point. If one of the inner cylinders 01, 23, for example the transfer cylinder 01 is considered, the passage to the forme cylinder 02 at the nip point takes place at a defined time, and the passage to the second transfer cylinder 23 at another time. Therefore the demands made on the optimal height h09, or the desired pressure P_{SOLL}, can be different for both passages. It is now possible to resolve this problem advantageously in two different ways.

In a first embodiment, a height $h09_{SOLL.1}$, or a pressure $P_{SOLL.1}$ is determined in the logical unit 18 in such

a way that a compromise is found, while observing the two dependencies, taking into consideration the relative amplitudes e1(t), e2(t), which minimizes the two relative amplitudes e1(t), e2(1) as a whole. The same applies to the two other cylinders 23, 24, taking into consideration the relative amplitudes e3(t), e4(t) for the height $h09_{SOLL.2}$, or the pressure $P_{SOLL.2}$. Then the respective actuator 11.1 or 11.2 is charged with the height h09, or with the respective pressure P1, P2, which is or will be regulated to $P_{SOLL.1}$ or $P_{SOLL.2}$, corresponding to this compromise for the existing roll-off speed v, via the associated regulating device 21.1, 21.2, and the controlled system 22.1, 22.2 embodied as valves.

In a second embodiment, a phase-dependent variation of the optimization takes place for the height h09, or the pressure P_{SOLL}. It is now possible to change the height h09 of the raised area 09 at least twice per revolution of the cylinder 01, 23 with the actuator 11, and in this case it assumes different values respectively at the time of the passage through the one or the other nip point. Then the height h09 is changed per revolution as a function of the angular position of the cylinder 01, 23 having the actuator 11. If more than one interruption 06 and/or raised area 09 is arranged in the circumferential direction of the cylinder(s) 01, 02, 23, 24, the number of the possibly required changes, or the number of the values of the height h09, possibly changes accordingly.

In the case of the four cylinders 01, 02, 23, 24, two pressures $P_{SOLL.1}$, $P_{SOLL.2}$ are issued by the logical unit 18 as the reference variables $P_{SOLL.1}$, $P_{SOLL.2}$, each of which is

fed into a lower order regulator device 19 of respective actuators 11 of a changeable raised area 09. Here, the two raised areas 09 are arranged on the two transfer cylinders 01, 23.

It is also possible to respectively arrange more than one raised area 09, for example two raised areas 09, in the circumferential direction. In this case a common regulator device 19, as well as a common reference variable P_{SOLL} can be provided per raised area 09 of the cylinder 01, 02, 23, 24, but also for all raised area 09 of a cylinder 01, 23. Also, all cylinders 01, 02, 23, 24 can have raised areas 09 and/or interruptions 06.

As explained above, in an advantageous embodiment the distance a09 (or the phase relation) between the interruption 06 and the raised area 09 is also designed to be variable.

In one embodiment this can take place, for example, mechanically in that an effective shape of the raised area 09, or its absolute position, is changed. In the first case, an axially extending spindle having the raised area 09 can have an appropriate shape on its exterior surface in such a way that, when turning the spindle by means of an actuator, not represented, another area of the exterior becomes effective as the raised area 09. In the second case fingers, which are for example arranged in a comb-like manner on the surface area of the base body of the cylinder 01, 02, can be moved in the circumferential direction by an actuator, not represented.

In another embodiment, the two cooperating cylinders 01, 02, 23, 24 are embodied to be variable in their angle of rotation position phi in respect to each other. In case the

interruption 06 and the associated raised area 09 are arranged on different cylinders 01, 02, 23, 24, the change in the relative angle of rotation position phi causes a change of the distance a09. For example, this can be realized in such a way that the two cylinders 01, 02, 23, 24 are rotatorily driven, mechanically independently of each other, by means of separate drive motors. In this case one of the drive motors, which as a rule are electronically synchronized, is impressed with an offset in its reference angular position for changing the distance a09. However, the change of the relative angle of rotation position can also be performed by means of customary mechanical devices, such as are common, for example, for setting the position in the circumferential direction.

The control, or regulation, of the distance a09 can take place in a manner corresponding to the explanations of the exemplary embodiments in accordance with Figs. 8 to 12. As explained in connection with the height h09, it is then possible to store appropriate interrelationships between the roll-off speed v and the distance a09, or optimization algorithms for creating a variation of the distance a09 as a function of the relative amplitude e(t), and possibly of the roll-off speed v.

List of Reference Numerals

01	Rotating component, cylinder, roller, transfer cylinder
02	Rotating component, cylinder, roller, forme cylinder
03	Surface area
04	Surface area
05	-
06	Interruption
07	Dressing, rubber blanket, printing forme, metal printing blanket
08	Groove, slit
09	Raised area, tongue/lip/bracket
10	Clamping and/or bracing device
11	Means for changing height, actuating means, actuator, hollow body
11.1	Means for changing height, actuating means, actuator, hollow body
11.2	Means for changing height, actuating means, actuator, hollow body
12	Groove
13	Interruption, cut, opening
14	Face
15	-
16	End, end of dressing (07)
17	End, end of dressing (07)
18	Logical unit
19	Regulator device

20	Lever mechanism
21	Regulating device, regulator
21.1	Regulating device, regulator
21.2	Regulating device, regulator
22	Controlled system, valve
22.1	Controlled system, valve
22.2	Controlled system, valve
23	Component, cylinder, counter-pressure cylinder, transfer cylinder
24	Component, cylinder, forme cylinder
A	Curve
B	Curve
C	Interrelationship
D	Interrelationship
a09	Distance
a1	Amplitude, course of vibration
a2	Amplitude, course of vibration
a3	Amplitude, course of vibration
a4	Amplitude, course of vibration
v1	Curve
v2	Curve
v3	Curve
v4	Curve
e(t)	Value, relative amplitude
e1(t)	Value, relative amplitude

e2(t)	Value, relative amplitude
e3(t)	Value, relative amplitude
phi	Angle of rotation position
h09	Height (09)
$h09_{IST}$	Reference variable
$h09_{SOLL}$	Reference variable
$h09_{SOLL.1}$	Reference variable
$h09_{SOLL.2}$	Reference variable
l09	Effective leg length
P	Pressure
P,1	Controlled system, valve
P,2	Controlled system, valve
P_{IST}	Actual value
P_{SOLL}	Reference variable
$P_{SOLL.1}$	Reference variable
$P_{SOLL.2}$	Reference variable
P_{SET}	Set value
S	Path, position
S_{IST}	Reference variable
S_{SOLL}	Reference variable
U	Voltage
U_{SOLL}	Reference variable

g	Value
v	Value, roll-off speed